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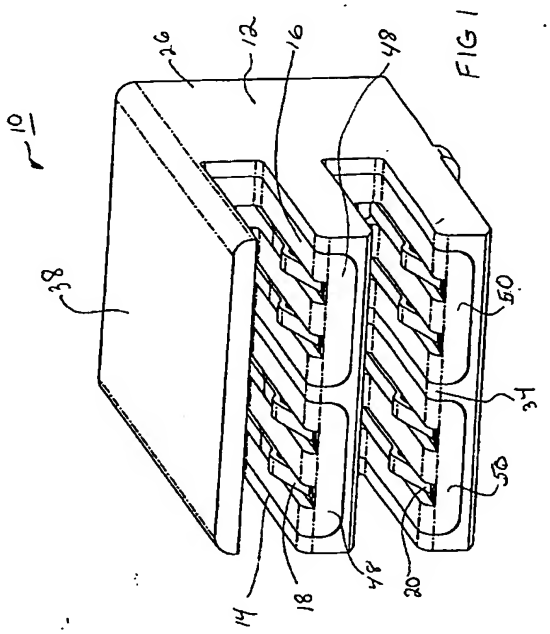
(54) Shielded compact data connector.

(57) An electrical connector component assembly (10) provides for shielding as between components of the connector. An electrically conductive outer housing (12) includes a plurality of discrete bounded compartments (30). A plurality of electrically insulative terminal support elements (14,16) are supported individually in the bounded compartments. Plural electrical contacts (18,20) are supported in at least one of the support elements. The electrical contacts supported in the one support element are electrically shielded from the components of the other support element by the bounded compartments.



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Field of the Invention

The present invention relates generally to improvements in shielded electrical data connectors. More particularly, the present invention relates to a compact design for a shielded electrical data connector wherein electrical contacts of the connector are electrically shielded from other components of the connector.

Background of the Invention

Improvements in the electrical data transmission industry, especially in the computer field, have resulted in the ability to transmit data along transmission lines at increasingly higher data rates. Further, similar improvements have also seen the decrease in the size of the equipment used in the industry. In order to function effectively with such equipment, the interconnection technology, such as the electrical cables and electrical connectors which connect such equipment, has also undergone significant improvements. Electrical connectors are now smaller and capable of transmitting data at higher rates between such components.

The requirement to make the electrical connectors smaller necessitates putting the conductive contacts of such connectors in closer proximity. However, when transmitting data at higher data rates, this physical proximity also increases the cross-talk levels between such electrical contacts. Accordingly, the industry has seen the need for improved shielding within the electrical connectors so as to reduce cross-talk levels in the smaller connectors working at higher data rates. This is especially prevalent in connectors used in closed-loop data systems which provide for continuity of signal in a multi-component system when certain of the connectors are not interconnected. These closed-loop systems employ connectors containing devices which permit automatic shunting so that a closed-loop connection is maintained even when a connector is in a non-connected condition. Such shunting devices in these connectors render effective shielding even more difficult.

It is, therefore, desirable to provide an electrical connector which provides for shielding in a compact connector design and which reduces cross-talk between contacts of the connector when operating at higher data rates.

Summary of the Invention

It is an object of the present invention to provide an improved shielded electrical data connector.

It is a further object of the present invention to provide a data connector of compact size which is operable at higher data rates.

It is a still further object of the present invention to provide a data connector having improved shielding which reduces cross-talk between contacts of the connector.

In the efficient attainment of these and other objects, the present invention provides an electrical connector which includes an electrically conductive outer housing having a plurality of discrete bounded compartments therein. Accommodated in the outer housing are a plurality of electrically insulative terminal support elements. Each support element is accommodated in one of the bounded compartments of the outer housing. Plural electrical contacts are supported in at least one of the terminal support elements. The bounded compartments of the outer housing serve to electrically shield the contacts of the one terminal support element from components supported in the other of the terminal support elements.

As more particularly described by way of the preferred embodiment herein, one electrically insulative terminal support element supports plural electrical contacts therein which provide for transmission of electrical signals therethrough. At least one other terminal support element may support either similar electrical contacts or signal transmission terminals of different function, for example fiber optic terminals. In either case, the electrical contacts of the one terminal support element would be electrically shielded from the components of the other terminal support element.

Brief Description of the Drawings

Figure 1 is a front perspective showing of the compact shielded data connector assembly of the present invention.

Figure 2 is a side-plan view of the connector assembly of Figure 1.

Figure 3 shows, in exploded perspective view, components of the connector assembly of Figures 1 and 2.

Figure 4 shows an electrical connector of Figure 1 interconnected with a like connector in hermaphroditic fashion.

Figure 5 is a rear-perspective view of the outer housing of the connector assembly of Figure 1.

Figures 6 and 7 are, respectively, exploded front and rear perspective views of the insulative support member and electrical contacts of the connector assembly of Figure 1.

Figure 8 is a perspective showing of alternative constructions of the electrical contacts of the connector assembly of Figure 1.

Figure 9 is a side-plan view of the alternative contacts of Figure 8 supported within the terminal support member.

Detailed Description of the Preferred Embodiments

Referring to Figures 1 - 3, a shielded compact electrical data connector assembly 10 of the present invention is shown. Data connector assembly 10 is of the type used to transmit data signals between components of a closed-loop data system. Connector assembly 10 may function in hermaphroditic fashion, that is, it is interconnectable to a similarly formed electrical connector assembly, or it may function in a panel mount environment where plural such connector assemblies are supported on a wiring panel for connection with similarly formed electrical connectors.

The connector assembly 10 of the present invention may be of the type shown and described in U.S. Patent Application Serial No. 08/013,452, filed February 4, 1993 entitled VERTICALLY ALIGNED ELECTRICAL CONNECTOR COMPONENTS, which is assigned to the assignee of the present invention and which is incorporated by reference herein for all purposes.

Connector assembly 10 comprises an electrically conductive outer housing 12, a pair of side by side electrically insulative support members 14 and 16, upper and lower electrical contacts 18 and 20, respectively, an insulative rear-contact support 22 and a rear-conductive shield 24.

Conductive outer housing 12 and conductive rear shield 24 are formed in the preferred embodiment of die-cast metal. However, other conductive elements such as conductive plastic or metalized plastic may be employed. Support members 14 and 16, as well as contact support 22, are formed of a suitably electrically insulative plastic. Electrical contacts 18 and 20 are formed of a suitably conductive metallic material such as beryllium copper.

Referring additionally to Figure 5, outer conductive housing 12 is shown in further detail. Outer housing 12 is generally an elongate rectangular member having a front interconnection end 26 and a rear contact accommodating end 28. Outer housing 12 is divided into four discrete compartments 30 arranged in side by side and upper and lower quadrants. Outer housing 12 includes a pair of opposed spaced-apart vertical side walls 32 and a central vertical dividing wall 34. A horizontal upper wall 38 extends across the upper extents of side walls 32 and dividing wall 34.

Outer housing 12 further includes intermediate horizontal bridge portions 40 extending between side walls 32 and dividing wall 34, as well as lower horizontal bridge portions 42, which also extend between side walls 32 and dividing wall 34. The construction of outer housing 12 provides for the complete perimetrical bounding of compartments 30. It is contemplated that in the preferred embodiment, the outer housing 12 will be integrally formed. However, individual components may be used to make up outer housing 12.

Referring now to Figures 6 and 7, terminal support members 14 and 16, as well as upper and lower contacts 18 and 20, are shown in more detail. Support members 14 and 16 are preferably of identical construction. For clarity of explanation, Figures 6 and 7 show only support member 14. Support member 14 is generally an elongate molded plastic member having a rear contact accommodating end 44, a central main body portion 46 and upper and lower support platforms 48 and 50 extending oppositely from rear contact accommodating end 44. Support member 14 includes a pair of side by side upper channels 52 extending from rear contact accommodating end 44 through central main body portion 46 and along upper support platform 48. Similarly, side by side lower channels 54 extend from the rear contact accommodating end 44 through central main body portion 46 and along lower support platform 50. Each support member 14 is divided into individual upper and lower stacked support elements 14a and 14b which include upper and lower support platforms 48 and 50, respectively. While support member 14 is shown to be integral, it is contemplated that the support member may comprise separate upper and lower support elements.

Figures 6 and 7 further show upper and lower electrical contacts 18 and 20 which are typically stamped and formed members. Lower contacts 20 include a generally elongate base portion 20a, a pin-type solder tail 20b and a reversely directed cantilevered spring portion 20c which extends back over base portion 20a. Solder tail 20b is of conventional construction and may be inserted into a through hole of a printed circuit board (not shown) and soldered thereto establishing electrical connection therebetween. In the present illustrative embodiment, solder tail 20b is shown extending downwardly at a right angle from base portion 20a, however, straight-solder tails may also be employed. Cantilevered spring portion 20c is constructed so as to be deflectable for movement toward and away from base portion 20a upon interconnection of a further connection device. Cantilevered spring portion 20c has an extended beam length which extends toward solder tail 20b.

Upper contacts 18 are of construction similar to that of contacts 20. Contacts 18 include an elongate base portion 18a, a solder tail 18b and a reversely directed cantilevered spring portion 18c of length shorter than cantilevered spring portion 20c of contact 20. As contacts 18 and 20 are arranged in upper and lower fashion, solder tail 18b of contacts 18 are longer than the solder tails 20b of contacts 20 so that the distal extents 18h and 20h of the solder tails extend approximately the same distance, facilitating connection of the solder tails to a printed circuit board.

As shown in Figures 6 and 7, upper contacts 18 include a depending shunt member 18d which is

struck from a central extent of planar base portion 18a. The distal extent 18e of shunt member 18d is engagable with the extended beam of cantilevered spring portion 20c of contacts 20 to provide for shunted engagement as between contacts 18 and 20. The description of the shunting between contacts 18 and 20 is described in further detail in the above-identified incorporated reference. Shunt member 18d of contact 18 extends downwardly from base portion 18a at an angle just less than 90°. Also, the distal extent 18e has a reversely curved portion. Upon shunting engagement of shunt member 18d with cantilevered spring portion 20c, a wiping engagement is achieved.

As shown in further detail in Figure 2, contacts 18 and 20 are supported within support member 14. Base portions 18a and 20a are supported respectively on platforms 48 and 50 through upper and lower channels 52 and 54. Solder tails 18b and 20b extend along rear contact accommodating end 44 of support member 14.

Support members 14 and 16 supporting upper and lower contacts 18 and 20 are inserted into outer housing 12 in side by side fashion. Each upper and lower support platform 48 and 50 of support members 14 and 16 are individually accommodated in one of the bounded compartments 30 of outer housing 12 (Fig. 5). Upper wall 38, side walls 32 and lower bridge portions 42 serve to shield collectively the contact 18 and 20. Dividing wall 34 serves to shield each of the side by side pairs of contacts 18 and 20. Intermediate bridge portions 40 serve to shield the upper contacts 18 from the lower contacts 20. Thus, each pair of contacts supported by each of the platforms, will be electrically shielded from the contact pairs of the other platforms by its residence in an individual bounded compartment 30. Further, intermediate bridge portion 40 includes spaced recesses 40a separated by a central protrusion 40b. Shunt member 18d of each contact 18 extends through recess 40a. The central protrusion 40b provides shielding as between adjacent shunt member 18d.

Referring again to Figures 2 and 3, the shielding of contacts 18 and 20 is continued at the contact accommodating end 28 of housing 12 by rear shield 24. Shield 24, formed of conductive metal, includes a short forward wall 56 and a taller rear wall 58 separated by a centrally located transverse web 60. Shield 24 provides conductive shielding as between solder tails 18b of upper contacts 18 and solder tails 20b of lower contacts 20. This is achieved by positioning solder tail 20b on one side of forward wall 56 while solder tails 18b are positioned on the other side of forward wall 56. Solder tails 18b reside between walls 56 and 58.

In order to support solder tails 18b of contacts 18, connector assembly 10 includes insulative contact support 22. Contact support 22 is a plastic member having a front wall 62, a taller rear wall 64 and individual chambers 66, which individually accommodate solder tails 18b of contacts 18. Contact support 22 includes a recess 68 extending from a lower edge thereof which accommodates web 60 of shield 24 when contact support 22 is inserted within shield 24.

In operation, once the support members 14 and 16 supporting contacts 18 and 20 are inserted into outer housing 12, shield 24, having contact support 22 inserted therein, may be inserted over the solder tails 18b of contacts 18 to reside adjacent contact accommodating end 28 of outer housing 12.

Referring to Figure 4, connector assembly 10 is shown interconnected to an identical connector 10' in hermaphroditic fashion. This is accomplished by rotating connector assembly 10' 180° and interconnecting the two parts so that upper contacts 18 of connector assembly 10 engage lower contacts 20' of connector assembly 10', while lower contacts 20 of connector assembly 10 engage upper contacts 18' of connector assembly 10'. It is noted that as the lower contacts of one connector engage the upper contacts of the other connector when connected in hermaphroditic fashion, the electrical path between each pair of the mated contacts will be the same for all contact pairs. Thus the electrical path length between the tip 18h' of solder tail 18b' and the tip 20h of solder tail 20b, which is connected thereto, is the same as the path length between the tip 18h of solder tail 18b and the tip 20h' of solder tail 20b' of another connected pair of contacts. By creating identical electrical path lengths, impedance mismatch is reduced as between mated pairs of contacts.

Referring to Figures 4 and 7, another feature of the present invention may be described. Cantilevered spring portions 18c and 20c of upper and lower contacts 18 and 20 further provide a first upwardly inclined contact surface 70 extending from the front end of the contacts to a centrally located apex 72. The contact further includes a depending rearwardly facing engagement surface 74 extending from apex 72 down to the distal end of the contacts. As hermaphroditic connection is made as shown in Figure 4, the first contact surfaces of the mating contacts will ride against each other until the apices of the respective contacts bypass one another. The inherent spring bias of cantilevered spring portion 18c and 20c permit such engagement. Once the apices are bypassed, the depending engagement surfaces 74 will engage in locking fashion. Thus the mechanical engagement of the mated contacts of the hermaphroditic connectors will serve, to some degree, to lock the contacts together thereby locking the respective connectors together. This locking feature also assures proper connection of connector assembly 10 to connector assembly 10'.

Further embodiments of the present invention may be shown in Figures 8 an 9. Contacts of the pres-

ent invention include solder type tails 18b and 20b such as shown in contacts 18 and 20 for attachment to through holes of a printed circuit board. However, the present invention also contemplates employing other contact types 76 and 78, which include IDC portions 76a and 78a for making insulation displacing connection to electrical conductors (not shown) in a manner described in the above-incorporated patent application. IDC portions 76a and 78a may extend at oppositely directed 90° angles from the central base portions 76b and 78b of contacts 76 and 78. Figure 9 shows such insulation displacement contacts 76 and 78 supported in a support member 14.

Additionally, since support members 14 and 16 may be inserted into outer housing 12 in a modular fashion, connector assembly 10 of the present invention may accommodate different transmission styles within the same connector assembly. While the present embodiment shows transmission terminal devices of the electrical signal type, other terminals, such as fiber optic terminations and power contacts, may be inserted into connector assembly 10. It is further contemplated that the transmission terminal device may be the stamped end of a co-axial cable where the center conductor serves as an electrical contact. Support members 14 and 16 can be adapted to accommodate such co-axial cable. Thus, connector assembly 10 may house mixed transmission components.

Various changes to the foregoing described and shown structures would now be evident to those skilled in the art. Accordingly, the particularly disclosed scope of the invention is set forth in the following claims.

Claims

1. An electrical connector comprising:
   an electrically conductive outer housing having a plurality of discrete bounded compartments;
   electrically insulative terminal support elements, each said support element being accommodated in one of said bounded compartments; and
   plural transmission terminal devices supported in at least one said support element;
   said terminal devices of said one support element being electrically shielded from the other said support elements by said bounded compartment.

2. An electrical connector of claim 1 wherein said transmission terminal devices of one said support elements are electrical contacts.

3. An electrical connector of claim 2 wherein at least another said support element supports additional electrical contacts.

4. An electrical connector of any one of claims 1 to 3 wherein said a pair of said electrically insulative terminal support elements are formed integrally in stacked relationship.

5. An electrical connector of claim 4 wherein said stacked terminal support elements have portions resident in a pair of vertically aligned said bounded compartments of said outer housing.

6. An electrical connector of claim 2 or claim 3 wherein each said electrical contact includes an interconnection end for electrical engagement with a contact of a mating connector and a terminal end opposite said interconnection end.

7. An electrical connector of claim 6 wherein said terminal end includes a pin-type solder tail.

8. An electrical connector of claim 6 wherein said terminal end includes an insulation displacement contact portion.

9. An electrical connector of any one of claim 1 to wherein said outer housing is formed from die cast metal.

10. An electrical connector of any one of claims 1 to wherein said connector is hermaphroditic.

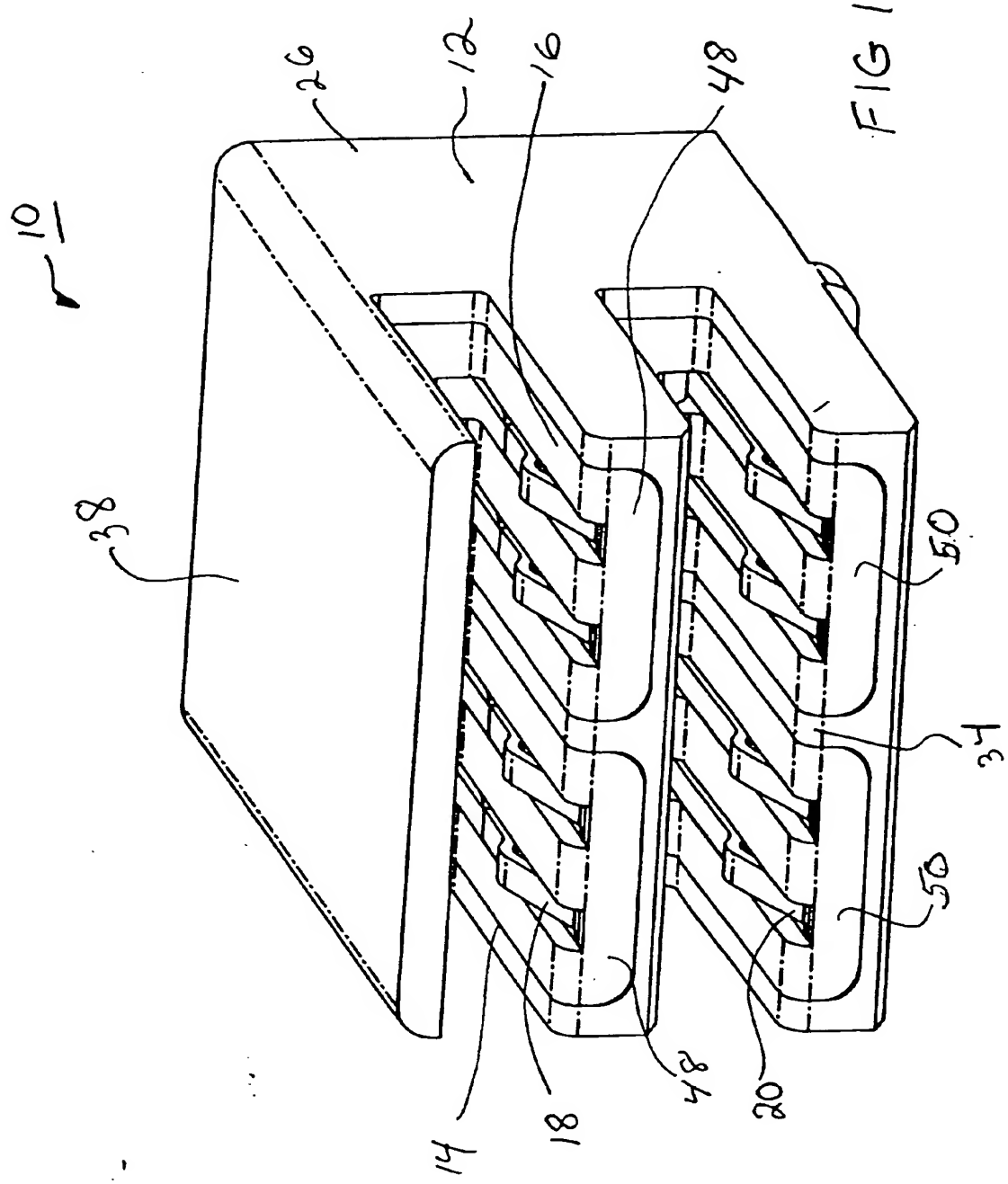

FIG 1

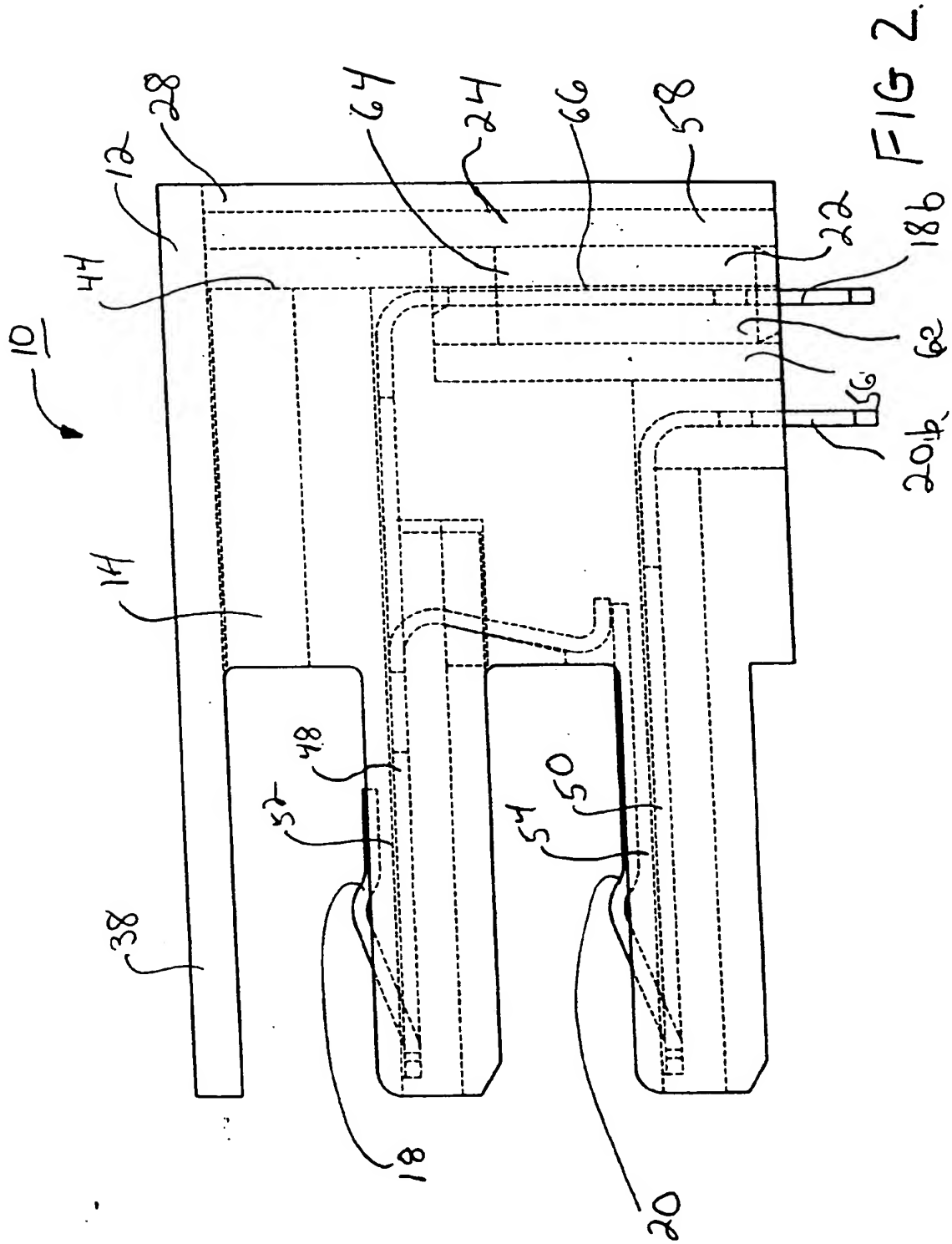

FIG 2.

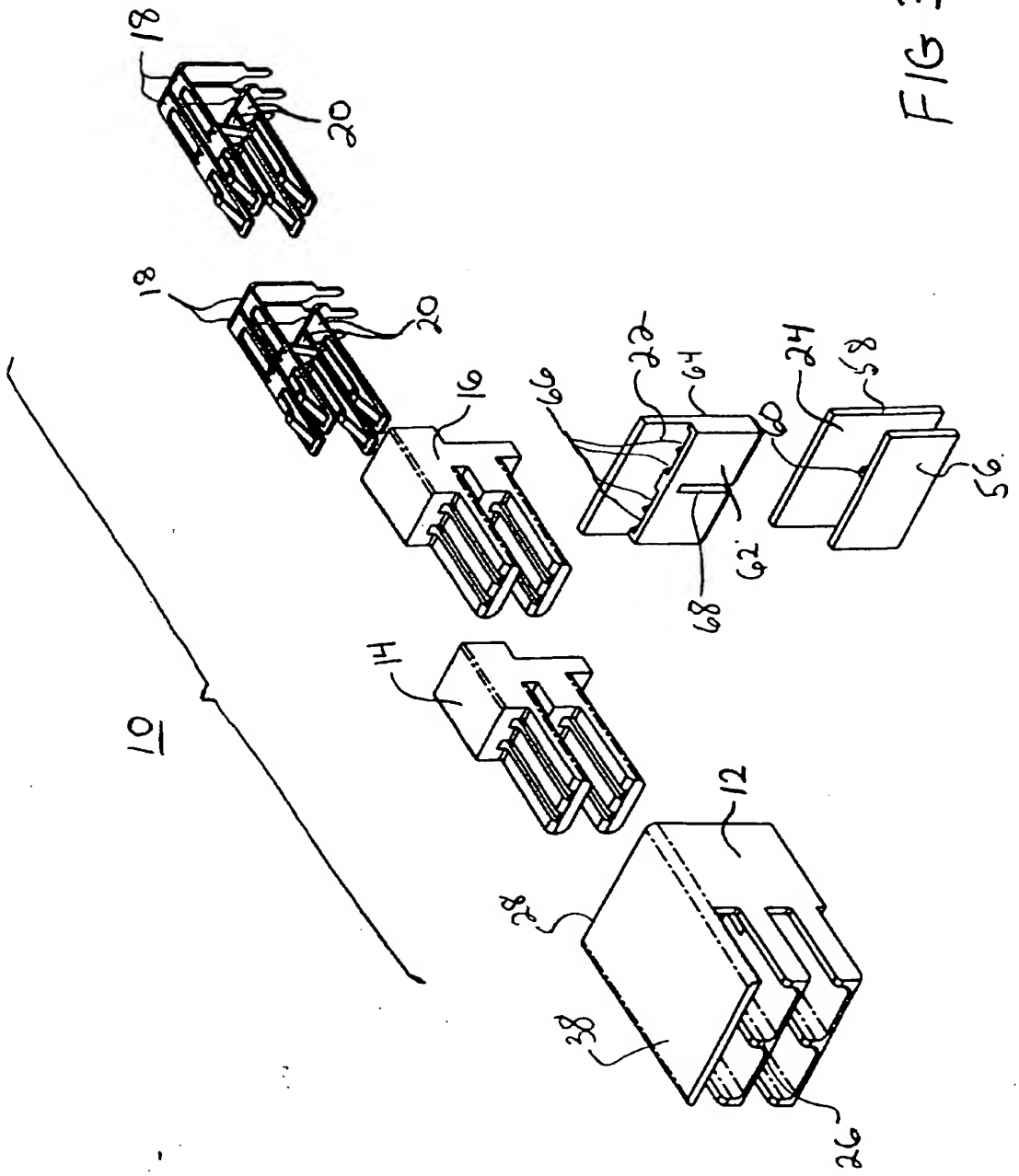

FIG 3

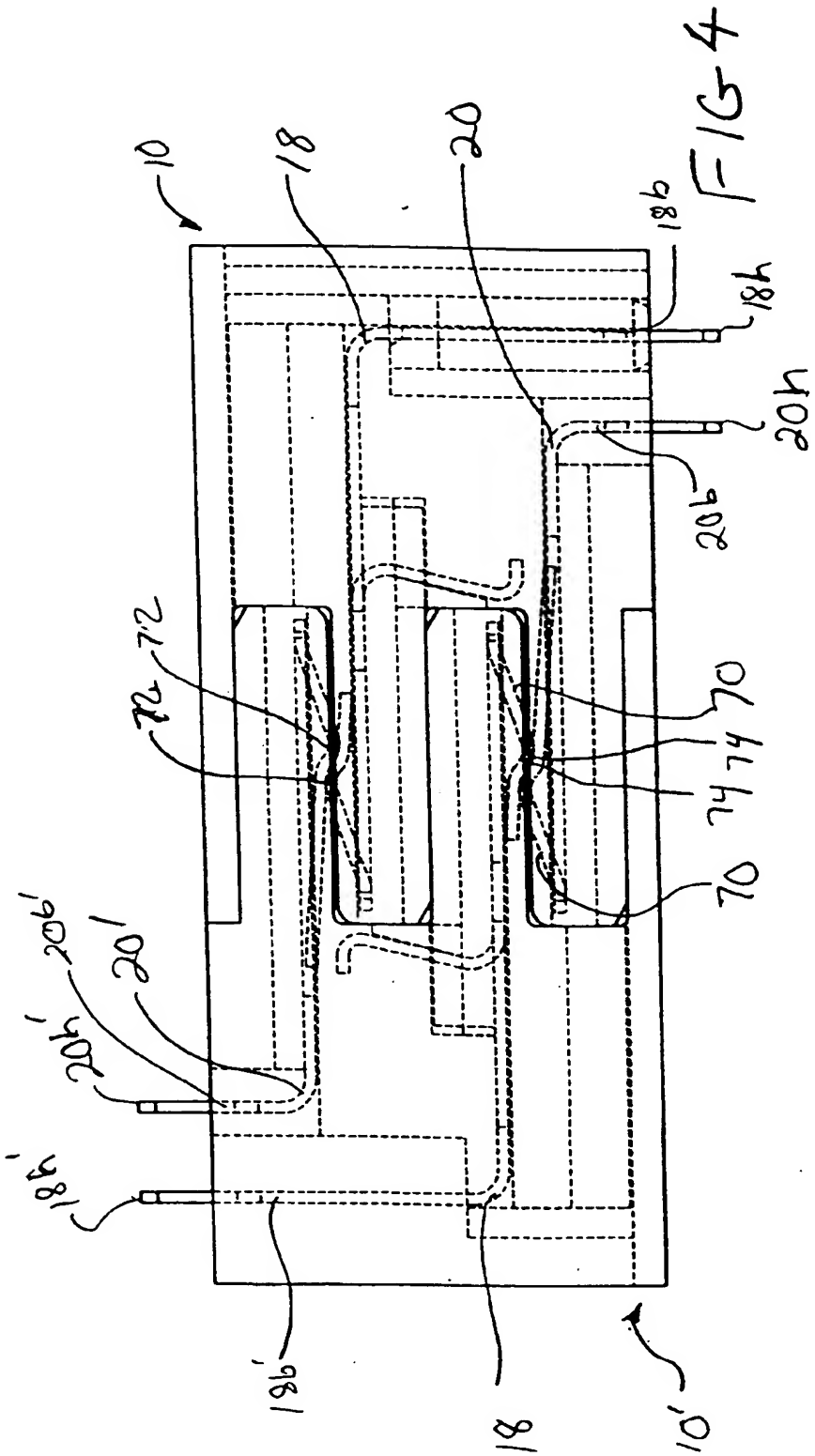

FIG 4

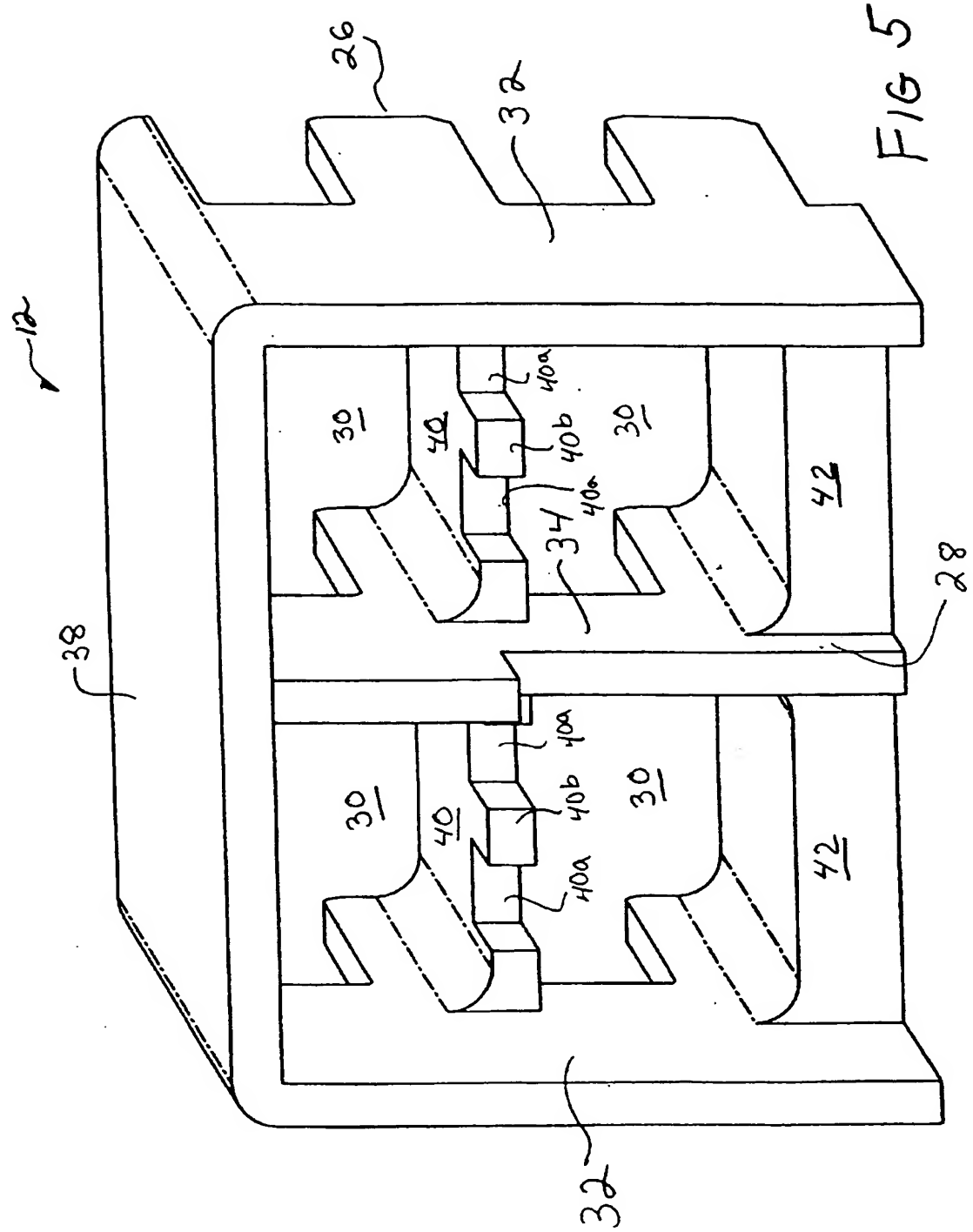

FIG 5

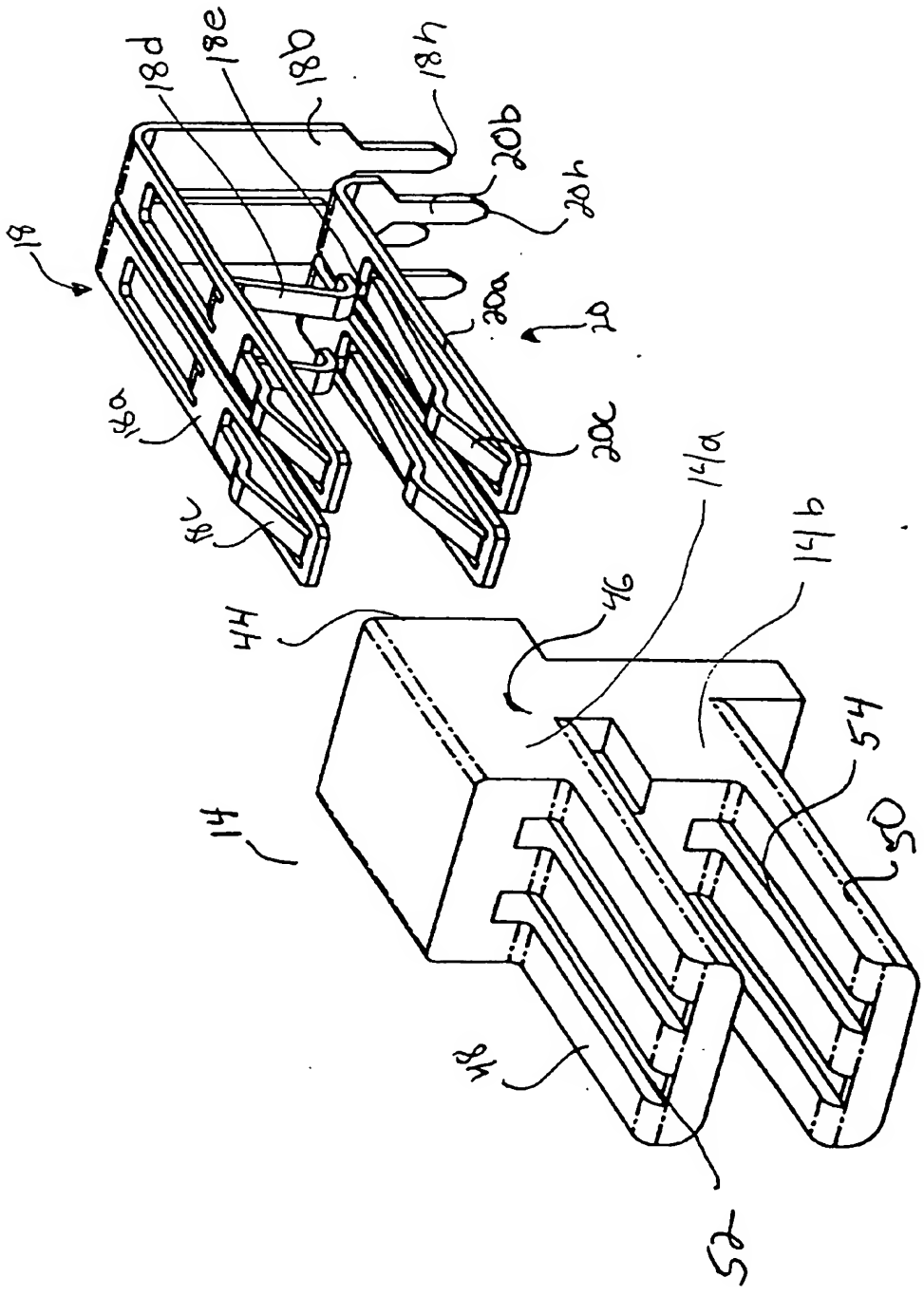
18d
18e
18c
18f
20b
20d
18
20a
20
18a
20c
18b
44
46
14a
14b
41
54
50
48
52

FIG 6

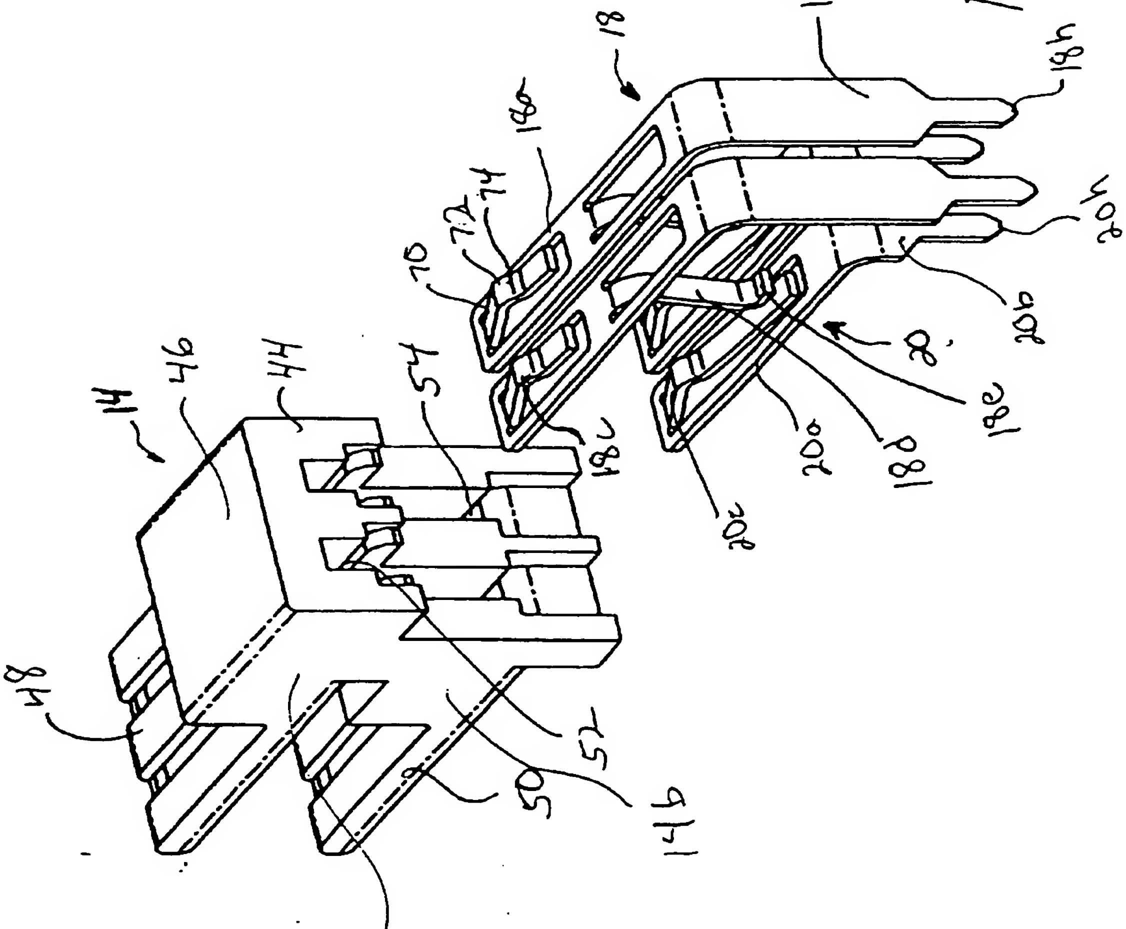

FIG. 7

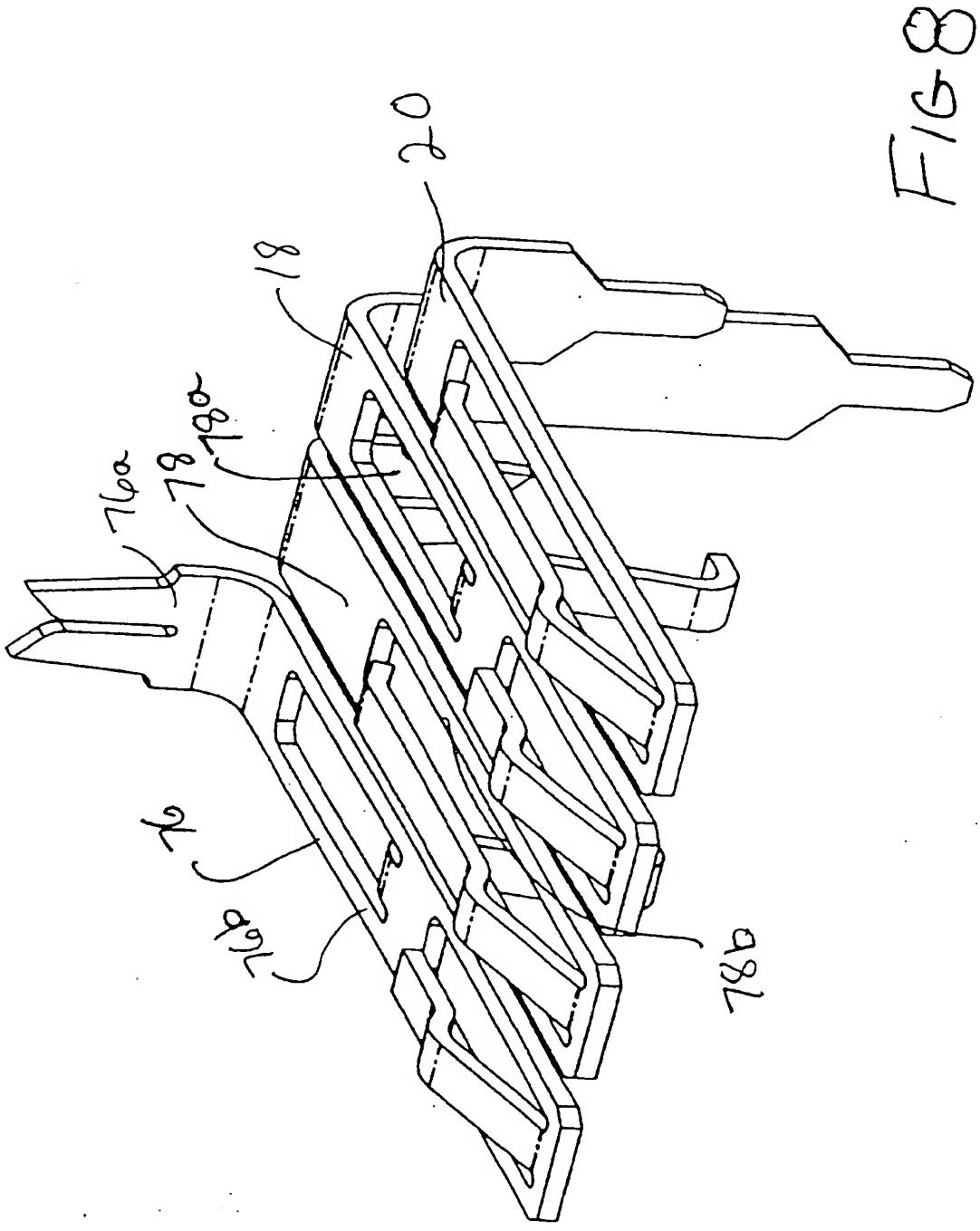

FIG 8

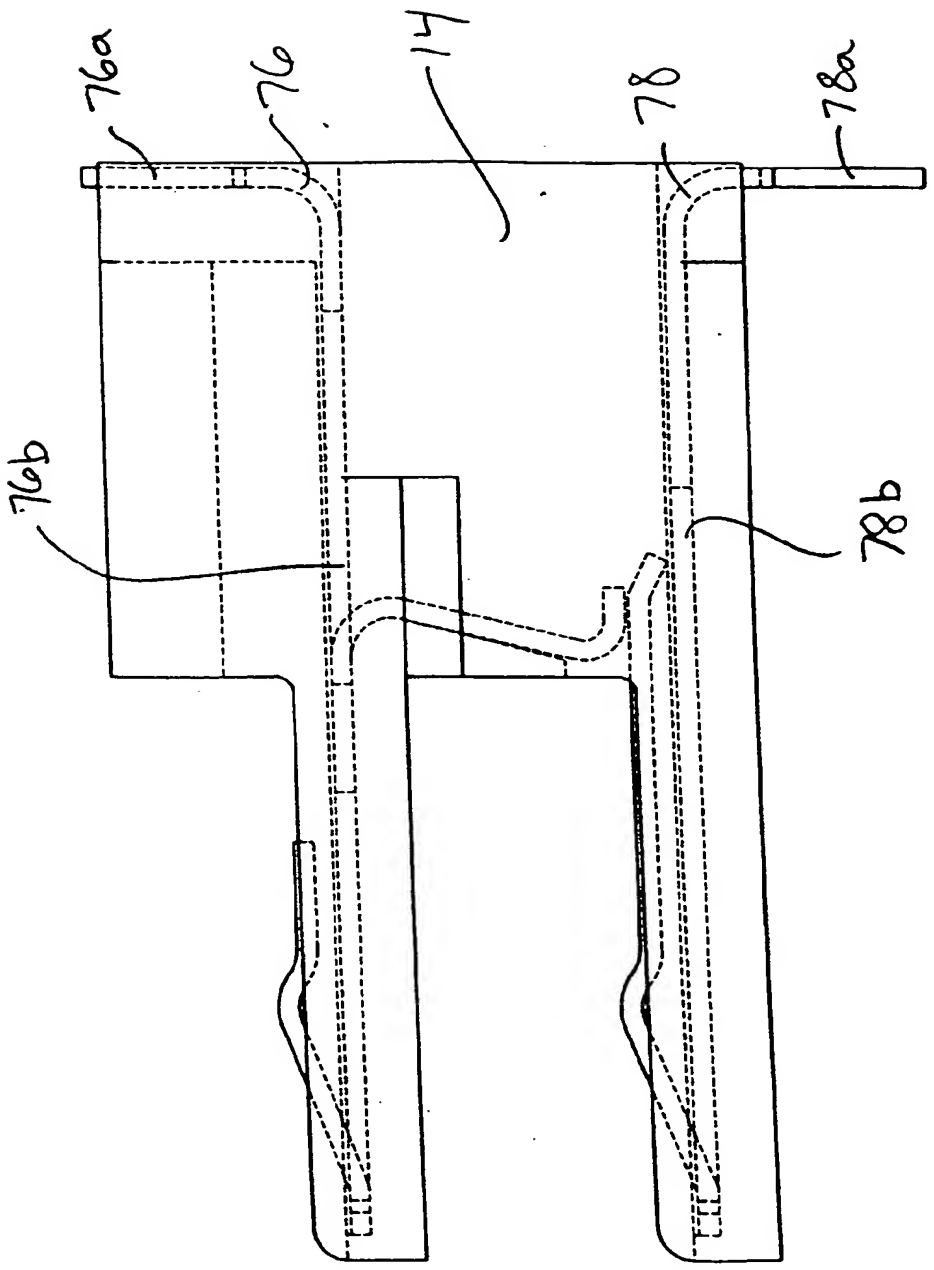

FIG 9